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TITLE: Process for producing electrode substrate for use in fuel cells

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CLAIMS:

What is claimed is:
1. A process for producing a porous carbonaceous electrode substrate provided with a group of elongated holes for reactant gases for fuel cells comprising the steps of (a) introducing into a metal mold of predetermined shape and dimension, in order,
(1) a first amount of a first material for producing said porous carbonaceous electrode substrate comprising 10 to 50% by weight of a filling material which is short carbon fibers or granular activated carbon, 20 to 40% by weight of a binding material which is selected from the group consisting of phenol resin, epoxy resin, furfuryl alcohol resin, pitch derived from petroleum or coal and mixtures thereof and shows a carbonization yeild of 30 to 75% by weight, and 20 to 50% by weight of a micropore-regulating material which is selected from the group consisting of polyvinylalcohol, polyvinylchloride, polystyrene, polyethylene, polypropylene, sucrose and mixtures thereof,
(2) a high polymeric substance in the shape of a cloth-like fabric or a grating-like molding for forming the elongated holes, which substance is selected from the group consisting of polyethylene, polypropylene, polystyrene, polyvinylalcohol and polyvinylchloride and gives a carbonization yield of lower than 30% by weight and
(3) a second amount of said first material for producing said porous carbonaceous electrode substrate, (b) press-molding the thus provided materials in the metal mold heated to from 70.degree. to 170.degree. C. under a molding pressure of from 5 to 100 kg/cm.sup.2 for from 1 to 160 min, (c) subjecting the thus press-molded material to after-hardening, and (d) then further calcinating the thus after-hardened material in an inert atmosphere at a temperature from 800.degree. to 3,000.degree. C. to thermal-decompose a larger part of said high polymeric substance to be carbonized, thereby forming said porous carbonaceous electrode substrate provided with said group of elongated holes opening from one side to the opposite side of the electrode substrate through nearly the central region of the thickness of the substrate.
2. A process according to claim 1, wherein said obtained porous carbonaceous electrode substrate comprises a uniform, porous carbonaceous material of a mean bulk density of from 0.3 to 1.0 g/cm.sup.3.
3. A process according to claim 2, wherein said mean bulk density is from 0.4 to 0.8 g/cm.sup.3.
4. A process according to claim 1, wherein said high polymeric substance does not volatilize nor show any melt-flow flow at a temperature of 100.degree. C.

5. A process according to claim 1, wherein said high polymeric substance in the shape of said cloth-like fabric has an equivalent diameter of 0.5 to 3.3 mm and is prepared by weaving single filaments of 0.5 to 3.3 mm in diameter made of said high polymeric substance or bundles of 0.5 to 3.3 mm in diameter formed by tying a plurality of single filaments made of said high polymeric substance.
6. A process according to claim 5, wherein the distance between the adjoining two single filaments or bundles of said cloth-like fabric is 1.5 to 5 mm in the direction parallel to the direction of a gaseous reactant flow in said electrode substrate when applied in a fuel cell, and is 1.5 to 50 mm in the direction perpendicular to said direction of said gaseous reactant flow.
7. A process according to claim 1, wherein said high polymeric substance in the shape of said grating-like molding is prepared by injection molding said high polymeric substance in a molten state into a metal mold or is prepared by press-molding pellets or powder of said high polymeric substance in a metal mold so that the equivalent diameter of the cross-section of frames of said grating is 0.5 to 3.3 mm.
8. A process according to claim 7, wherein the distance between the adjoining two frames of grating in said grating-like molding is 1.5 to 5 mm in the direction parallel to the direction of a gaseous reactant flow when applied in a fuel cell, and is 1.5 to 50 mm in the direction perpendicular to the direction of said gaseous reactant flow.
9. A process according to claim 1, wherein said short carbon fibers are 5 to 30 mm in diameter and 0.05 to 2 mm in length and give a linear contraction rate of not more than 3.0% when carbonized and calcinated at 2,000.degree. C. in an inert atmosphere.
10. A process according to claim 1, wherein more than 70% by weight of said micropore-regulating material has a diameter of from 30 to 300 mm.
11. A process according to claim 1, wherein said afterhardening is carried out for at at least 2 hours at a temperature of said press-molding.
12. A process according to claim 1, wherein said calcinating is carried out for about one hour.